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Statement
of
Sean O'Keefe
Administrator
National Aeronautics and Space Administration

before the

Subcommittee on VA-HUD-Independent Agencies
Committee on Appropriations
House of Representatives

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Mr. Chairman and Members of the Subcommittee, I appreciate the opportunity to appear before the Subcommittee today to discuss the President's FY 2004 budget proposal of $15.47 billion for NASA. The President's request demonstrates the Administration's continued confidence in NASA's ability to advance the Nation's science and technology agenda.

We come together to discuss NASA's space research and exploration agenda, and our efforts to advance aviation safety and efficiency in this Centennial of Flight year, still mourning the tragic loss of the courageous crew of the Space Shuttle *Columbia*. Before I discuss the details of the budget, I would like to provide the Subcommittee an update about the on-going investigation.

Since the tragic loss of *Columbia*, our work continues to honor the solemn pledge we've made to the families of the astronauts and to the American people that we will determine what caused the loss of *Columbia* and its crew, correct what problems we find, and safely continue with the important work in space that motivated the *Columbia* astronauts and inspires millions throughout the world. A grateful Nation has laid to rest with full honors, six American heroes: Rick Husband, William McCool, Mike Anderson, Dave Brown, Kalpana Chawla and Laurel Clark. The people of the state of Israel also paid their final respects to Israel's first astronaut, Ilan Ramon. At all these ceremonies, NASA was represented by myself and/or other appropriate Agency officials. We continue to be sensitive to, and supportive of, the needs of the astronauts' families and will be at their side as long as our support is desired by them.

I am pleased to note that the Senate passed S. 628, the Columbia Orbiter Memorial Act, on March 18. The companion bill in the House of Representatives, H.R. 1297, introduced by Mr. Young, was referred to the House Committee on Science and the Committee on Veterans Affairs, which reported the measure favorably on Mach 26 and April 3, respectively. I am also pleased to note that the measure has been incorporated as Title III in S. 762, the FY 2003 Department of Defense Supplemental Appropriations Act, passed by the Senate on April 3; the supplemental measure is scheduled to be the subject of Conference action with the House this week. The Columbia

Orbiter Memorial Act authorizes construction of a memorial at Arlington National Cemetery to honor the crew of STS 107.

Columbia Recovery operations, which began as soon as it became clear that *Columbia* was lost, have continued on the ground, in places along the Shuttle's reentry path, stretching from San Francisco, California to Lafayette, Louisiana, where we hope to recover more vital debris from the accident. We continue to send everything we find to the Kennedy Space Center in Florida for assembly and analysis as part of the Columbia Accident Investigation Board's comprehensive accident investigation. In addition, we are appreciative of the fact that the FY 2003 Omnibus Appropriations Act included $50 million in funding to help pay for the costs of the recovery operation and accident investigation by the Columbia Accident Investigation Board. We have established a new accounting code in the NASA financial system to capture the agency's costs associated with *Columbia* recovery and investigation, titled Columbia Recovery and Investigations. We are monitoring very closely the costs associated with this effort and we will ensure that the Congress is kept apprised of this effort. The Federal Emergency Management Agency is shouldering the resources required by other public agencies at the federal, state, and local levels.

The careful search for debris will continue in the weeks and months ahead. This search is still extremely helpful to the investigation. The debris recovery teams are finding on average 1,000 items a day as they cover thousands of acres per day, depending on terrain. NASA is deeply grateful for the support we have received during recovery operations from the more than 4,000 men and women from the Department of Homeland Security, Federal Emergency Management Agency, Environmental Protection Agency, Federal Bureau of Investigation, Department of Defense, Department of Transportation, U.S. Forest Service, U.S. Park Service, Texas and Louisiana National Guard, state and local authorities, and private citizen volunteers who have helped us locate, document, and collect debris.

I returned from Lufkin, Texas on March 24, where I met with many of the volunteers in the surrounding area who are involved in the *Columbia* recovery effort. I saw firsthand their dedication and I can report to the Subcommittee that morale is high and the continued commitment is strong to recover as much of *Columbia* as we can. The NASA family is grateful for their assistance.

I am saddened to note that one of the helicopters searching for debris from the Space Shuttle Columbia crashed in the Angelina National Forest in east Texas on March 27. The pilot and a Forest Service Ranger were killed in the crash, and three other crewmembers were injured. Our thoughts and prayers go out to the families of the helicopter crew members killed in the accident. We deeply empathize with their loss at such a trying time. We also pray for the speedy recovery of the injured crew members

There are approximately 5,700 personnel working in Texas involved in the shuttle material recovery effort. The field operations involve three main components--ground, air, and water search efforts--to search an area of 250 miles long by 10 miles wide. In each of these operations the searchers, NASA engineers, and EPA technicians are working side-by-side.

The ground search depends on fire crews from 42 States, operating out of four base camps, supported by two local logistics centers. So far, they have searched over 250,000 acres, or about 45% of the total ground search area.

The air search depends on 35 helicopters operating out of two air bases, each staffed by forest service pilots and NASA engineers. They have searched over 1.1 million acres, or about 60% of the total air search area.

The search of Lake Nacogdoches and the Toledo Bend Reservoir depends on the collaborative efforts of 66 United States Navy and state Police divers and a team of side-scan and multi-beam sonar analysts. So far, they have identified over 2,000 targets and cleared approximately 1,500 of them.

The meticulous search for evidence is resulting in important clues that will assist the work of the Columbia Accident Investigation Board. As of this date, nearly 48,000 pounds of debris have been recovered, representing approximately 22 percent of Columbia's dry weight. Of the 38,000 specific items recovered from the accident, more than 34,000 have been identified, with 314 of these coming from the left wing of the Orbiter.

Through the assistance of research institutions and helpful citizens, we have received video tapes that document *Columbia's* final moments as it streaked across the southwestern United States. The videos pick up *Columbia* as it approached the coast of California and cover most of its flight path toward the skies over East Texas, with the exception of some gaps in video coverage of *Columbia's* flight path over sparsely populated areas of eastern New Mexico and northwestern Texas. The video imagery is being used along with radar and telemetry data to help engineers determine the potential location of debris that was shed from *Columbia*.

The Independent Columbia Accident Investigation Board under Admiral Gehman has made significant progress in organizing its work to determine the cause of the accident. NASA has kept its pledge to fully cooperate with the work of the Board, and has taken the necessary steps to ensure the Board's complete independence.

Implications of Suspension of Shuttle Flights

The ISS Expedition 6 crew--Commander Ken Bowersox, Science Officer Donald Pettit and Cosmonaut Flight Engineer Nikolai Budarin--continue to perform science while performing routine ISS maintenance on orbit. There are no threats to the ISS or its crew in the near-term, and we are working options to be able to sustain both over the long-term. All remaining U.S. manufactured ISS hardware for the Core Complete configuration has been delivered to KSC and element ground processing is on schedule. Delivery of Node 2, built for NASA by the European Space Agency, is on schedule for April 2003. Ground processing will continue until ready for Shuttle integration. Only one ISS mission, STS-118, in the critical path to U.S. Core Complete was manifested on Columbia. The primary mission objective of STS-118 is the transfer and installation of the S5 Integrated Truss assembly to the S4 Truss. While the manifest for the remaining three Orbiters will need to be adjusted to accommodate this flight, all other previously scheduled ISS assembly missions will be flown in their original order. A revised U.S. Core Complete assembly schedule will be confirmed when the Shuttle is ready to return to flight status.

In the absence of Space Shuttle support, NASA is addressing contingency requirements for the ISS for the near- and long-term. As I said earlier, there is no immediate danger to the Expedition 6 crew. In order to keep the crew safe, however, we must ensure that they have sufficient consumables, that the ISS can support the crew, and that there is a method for crew return available. Working closely with our international partners, we have confirmed that there is sufficient propellant on-board the ISS to maintain nominal operations through the end of this year. With the docking of the Progress re-supply spacecraft on February 4 (ISS Flight 10P), the

crew has sufficient supplies to remain on the ISS through June without additional re-supply. As we move beyond June, however, potable water availability becomes the constraining commodity. We are currently working closely with our Russian partner, Rosaviakosmos, to explore how best to address this issue on future near-term ISS re-supply missions. A Soyuz spacecraft (ISS Flight 5S) is docked to the ISS and serves as a rescue vehicle for crew return in the event of a contingency. These Soyuz spacecraft have an on-orbit lifetime limitation of approximately 200-210 days, and must be replaced periodically. The Soyuz 5S vehicle will reach its lifetime limit in late April/early May, and will need to be returned.

We are currently evaluating strategies with our International Partners to keep the ISS crewed and supplied with sufficient consumables, and to replace the Expedition 6 Crew. The ISS Partnership is committed to maintaining crew on-orbit. To address the near-term anticipated shortfall in potable water, one of the strategies that NASA and its partners are considering is bringing up a new crew of two (one U.S. and one Russian) on the next Soyuz spacecraft (ISS Flight 6S), scheduled for launch in late April to replace the Expedition 6 Crew of three. We are also working closely with Rosaviakosmos to evaluate the flexibility and constraints of the Progress flight schedule to support the crew.

In the unlikely event that de-crewing is required, the ISS can be configured and de-crewed using established contingency procedures. The ISS can remain without a crew for an extended period of time while maintaining altitude with Progress and onboard re-boost capability, without crew interaction. NASA will continue to meet its commitments to our ISS International Partners. Once we understand what caused the *Columbia* accident and can return to flight, we will resume assembly of the ISS.

The ISS, now in its third year of human occupancy, represents an important milestone in history. Due to this capability, humans are now able to permanently occupy the realm outside of Earth and are actively conducting ambitious research spanning such scientific disciplines as human physiology, genetics, materials science, Earth observation, physics, and biotechnology.

Columbia was the orbiter which was to have been used for the 4th servicing mission of the Hubble Space Telescope (HST) planned for November 2004. NASA can continue to service the HST, and any Orbiter is capable of supporting HST servicing missions. Furthermore, the HST is performing well, and is a robust observatory in no immediate need of servicing. Should a delay in the planned servicing mission occur that impacts the Telescope's ability to perform its science mission, HST can be placed in safe mode until a servicing mission can be arranged.

Anticipating A Return to Flight

We have begun prudent and preliminary planning efforts to prepare for 'return to flight' in order to be ready to implement the findings of the Columbia Accident Investigation Board. NASA's 'Return to Flight' analysis will look across the entire Space Shuttle Program and evaluate possible improvements for safety and flight operations that we were considering prior to the *Columbia* accident. I have selected Dr. Michael A. Greenfield, Associate Deputy Administrator for Technical Programs, to lead our Return to Flight team along with William Readdy, Associate Administrator for Space Flight. This team will be composed of a number of key officials and safety professionals from within the space flight community. Their experience in shuttle operations and the investigation to date will provide a sound foundation for this critical activity.

FY 2004 Budget Request

On that sunny Saturday morning, February 1st, as I awaited the landing of the *Columbia*, I was contemplating my return to Washington, D.C., to prepare for the release of NASA's FY 2004 budget. We had worked aggressively over the past year to develop a new Strategic Plan and fashion a budget to make it a reality. I was excited about announcing these plans with the release of the President's FY 2004 Budget in two days. I had no idea how that tragic morning would change my focus over these ensuing weeks. During the days that followed, I was asked by some whether the Columbia accident would force us to toss aside our budget and long-range plans. Mr. Chairman, I will tell you as I told them, I think not. A test of any long-term plan is whether it can accept the inevitable setbacks and still achieve its goals. That is my hope for our plan.

Mr. Chairman, in light of the recent tragic loss of *Columbia*, we must recognize that all exploration entails risks. In this, the Centennial Year of Flight, I am reminded of an accident that occurred just across the river at Ft. Myer in 1908 onboard the Wright flyer. The Wright brothers were demonstrating their flying machine to the U.S. Army, and a young lieutenant was riding as an observer. The flyer crashed, and Lt. Thomas Selfridge died of head injuries, thus becoming the first fatality of powered flight. From that accident in 1908 came the use of the crash helmet. So too from *Columbia* we will learn and make human space flight safer.

Although the budget proposal was prepared prior to the loss of *Columbia* and its crew, I am convinced that NASA's FY 2004 budget proposal is responsible, credible, and compelling. It is **responsible** by making sure that our highest priorities are funded; it is **credible** by ensuring that adequate budget is built into the most technically challenging programs, and that we will fully account for the costs of all our programs; and, it is **compelling** by allowing NASA to pursue exciting new initiatives that are aligned with our strategic objectives. As I mentioned previously, the President's FY 2004 budget request for NASA is $15.47 billion. While I will not rule out potential adjustments to this proposal that may be appropriate upon completion of the independent Gehman Board investigation, I look forward to discussing the FY 2004 budget request and how it advances our mission goals of understanding and protecting the home planet, exploring the Universe and searching for life, and inspiring the next generation of explorers, and, in so doing, honoring the legacy of the *Columbia* astronauts.

Establishing Our Blueprint

Today's discussion is about more than changes in the budget – which is usually just a discussion over how one might change a few percent of one's budget from the year to year – but instead it is about a new strategic direction for NASA and how we are planning to shift our resources toward our longer-term goals. In April 2002, I gave a speech at the Syracuse University that espoused a new Vision and Mission for NASA. There are only 13 words in NASA's Vision and 26 words in NASA's Mission, but every word is the product of extensive senior leadership debate within NASA. And what you see in our new Strategic Plan is the product of those discussions, and the product that the entire NASA team is committed to delivering for the American people. Indeed, we did not need to release this Strategic Plan with our budget – after all, the law stipulates September 2003 – but we felt that if we are serious about our Vision and Mission, we must have it during our budget deliberations and release it simultaneous with our budget.

NASA's strategy for the future represents a new paradigm. In the past, we achieved the marvel of the moon landing, an incredible achievement that has shaped much of NASA today, driven by a great external event – the Cold War – that allowed our Nation's treasury to be aggressively

spent on such a goal. Today, and in the decades since Apollo, NASA has had no comparable great external imperative. This, however, does not mean that we cannot lift our eyes toward lofty goals and move up the ladder – using the ***stepping stones*** we have identified. We believe that we can make great strides in our exploration goals – not on some fixed timescale and fixed location – but throughout our solar system with ever more capable robotic spacecraft and humans to enable scientific discovery. Hence, we will not be driven by timeline, but by science, exploration, and discovery. We will pursue ***building blocks*** that provide the transformational technologies and capabilities that will open new pathways. We can do this within our means. And if someday there is an imperative or new discovery that pushes us further, we will be ready and well along the way.

To be successful, we will transform ourselves as follows:

- All investments will contribute to our goals and traceable to the Vision and Mission. Every NASA program and project must be relevant to one or more of the goals, and perform successfully against measures.
- Human space flight capabilities will be enhanced to enable research and discovery. We will continue to expand human presence in space -- not as an end in itself, but as a means to further the goals of exploration, research, and discovery.
- Technology developments will be crosscutting. We will emphasize technologies with broad applications, such as propulsion, power, computation, communications, and information technologies.
- Education and inspiration will be an integral part of all our programs. We will track performance of our education programs like that of any other NASA activity.
- We will operate as One NASA in pursuit of our Vision and Mission. We will reinforce the shared commitment of all NASA employees to our common goals.
- As Only NASA Can: We will pursue activities unique to our Mission -- if NASA does not do them, they will not get done -- if others are doing them, we should question why NASA is involved.

Strengthening our Foundation

This building block and stepping stone approach already has one important brick in place: the FY 2003 Omnibus Appropriations Act, signed by the President on February 20. The FY 2003 appropriation contains many of the needed elements that will help NASA address important constraints in power, transportation, and human capabilities. The FY 2003 budget contains funding for NASA's:

- *Nuclear Systems Initiative* to develop new power and propulsion technologies that will enable solar system exploration missions that are inconceivable with current conventional chemical propulsion systems. This initiative has been incorporated in *Project Prometheus* as part of our FY 2004 Budget request.

- *International Space Station (ISS)*, including full funding to assure we can successfully reach the milestone of U.S. Core Complete—which will enable accommodation of International Partner elements--maintain progress on long-lead items for enhanced research, and continue to build out this research laboratory platform for overcoming human limitations in space. It also includes authority to proceed with establishment of a Non-Governmental Organization (NGO) for ISS research. This funding and authority builds on our major achievements over the past year. We have received endorsements by two independent cost teams that deemed the program's cost estimates as "credible" and the ISS Management and Cost Evaluation

(IMCE) independent task force, chaired by Tom Young, that commended our progress against their recommended management reforms. We have revamped our science program towards the highest priority research as identified by the Research Maximization and Prioritization (ReMAP) independent task force. We have put in place a new management team to control program content, ensure science requirements are met, and refocus program from development to operations. Finally, we are implementing new financial management tools to better manage our resources.

- *Integrated Space Transportation Plan* (ISTP) that will address our Nation's near and mid-term requirements in human space flight by making investments to extend the Shuttle's operational life for continued safe operations; developing a new Orbital Space Plane to provide a crew transfer capability as early as possible to assure access to and from the International Space Station; and, funding next-generation launch vehicle technology in such areas as propulsion, structures, and operations. Since providing our ISTP as part of the FY 2003 budget amendment in November 2002, we have moved out aggressively on this roadmap. We are refining the Shuttle's Service Life Extension Program to better identify priorities and long-term investments. We also have completed top-level requirements for the Orbital Space Plane and awarded contracts to address priority technologies and areas of risk. Finally, we are refining our investments in long-term launch technologies as part of our recently initiated space architecture activities. We believe the ISTP is a good plan, but we are committed to re-examining it if necessary in light of future investigation findings on Columbia.

We must ensure that we have a sound foundation -- our people, processes, and tools -- from which to build our programs. It is only from such a sound foundation that we can go forward to more ambitious plans. We have placed the highest priority on achieving the goals of the President's Management Agenda, which contain five Government-wide initiatives that promise to significantly improve our management foundation:

- *Human Capital*: We have begun to implement our strategic human capital plan, including a tracking system to identify workforce deficiencies across the Agency. I will address this very important issue at the conclusion of my remarks.
- *Competitive Sourcing*: We have achieved the government-wide, 15 percent competitive sourcing goal, and are pursuing, wherever feasible, new opportunities for competition, including the renewal of contracts.
- *Financial Performance*: We have addressed all issues contained in the disclaimer opinion on NASA's 2001 audit and been given a clean opinion for 2002.
- *E-Government*: We are addressing information technology security issues and reviewing and enhancing other IT capabilities.
- *Budget & Performance Integration*: We are budgeting for the full cost of NASA's programs and have integrated our budget and performance plan starting with FY 2004 Budget.

Mr. Chairman, I would like to specifically highlight NASA's newest Enterprise, Education. The Education Enterprise was established in 2002, to inspire more students to pursue the study of science, technology, engineering and mathematics, and ultimately to choose careers in those disciplines or other aeronautics and space-related fields. The new Enterprise will unify the educational programs in NASA's other five enterprises and at NASA's 10 field Centers under a One NASA Education vision. NASA's Education vision will permeate and be embedded within all the Agency's activities.

Linking Investments to Strategic Plan

Simultaneously with the submission of the President's FY 2004 budget request, we submitted to the Congress the Agency's new Strategic Plan, our Integrated Budget and Performance Document, and our Performance and Accountability Report. I believe the sweeping changes we are proposing in our FY 2004 Budget represent the most ambitious in our history and will enable us to vastly improve our ability to align our investments with our goals, assess progress, and make sound economic and technical decisions based on accurate and timely information. These improvements include:

- *Budget Restructure* – In response to our new Strategic Plan, we have restructured our budget. NASA's new Strategic Plan recognizes that we are organized by those Mission-driven activities that deliver our end products—Space Science, Earth Science, Biological and Physical Research, Aeronautics, and Education—and by those activities -- International Space Station, Space Shuttle, Space Flight Support, and Crosscutting Technology -- that enable our Mission-driven activities to succeed. To mirror the organization of activities in our Strategic Plan into mission-driven efforts and supporting capabilities, and to recognize the reality that there is no arbitrary separation between human and science activities, the FY 2004 budget replaces the previous structure with two new appropriation accounts: *Science, Aeronautics and Exploration*; and, *Space Flight Capabilities*. For FY 2004, the request includes $7.661 billion for *Science, Aeronautics and Exploration* and $7.782 billion for *Space Flight Capabilities.*

  Furthermore, the budget is structured in 18 goal-oriented *Themes***,** which aggregate programs to be managed as a business portfolio in pursuit of common goals and performance measures.

- *Full Cost Accounting and Management* – In a landmark event, we have allocated all our costs by program areas. Throughout our history, NASA has treated the cost of institutional activities (personnel, facilities, and support) separate from the programs they benefit. This has made economic trades difficult to analyze. In this budget, we have placed all costs against programs so that, for the first time, we can readily determine the true total costs of programs and allow managers to make more efficient and effective choices.

- *Integrated Budget and Performance Document* – We have revamped our Congressional justification with a new document that merges our restructured budget with our performance plan. The document highlights the 18 themes and associated performance measures. Moreover, it clearly identifies projects approved for full scale development, including promised cost, schedule, and technical parameters.

- *Integrated Financial Management System* – After a decade of trying, we are successfully bringing online a new integrated financial management system. For the first time in the agency's history, we will have one financial system for all our Field Centers, a major step in our *One NASA* goal. The core financial module will replace the legacy systems at all our Centers by this summer. This new system implementation is critical for enabling successful management of the budget, cost, performance, and the accounting changes mentioned above. Moreover, this new system will significantly enhance our ability to maintain a clean financial audit opinion.

Pursuing Critical New Opportunities

At NASA, we are developing *building blocks* that open new pathways of exploration and discovery. Today, our telescopes peer billions of years into the past to witness the beauty and unlock the mysteries of the early universe. Our satellites view the entire planet from space, allowing us to study global change and its consequences for life on Earth. Our spacecraft travel throughout the solar system and into the uncharted territories beyond, exploring the processes that have led to the incredible diversity of the planets and the emergence of life. Our aeronautics research has given people the routine ability to travel safely and reliably all around the world. Our astronauts are living and working in space, and from them, we are learning how to expand our sphere of exploration far beyond the bounds of Earth.

But, our ability to fully achieve our Mission is constrained by the need for new technologies that can overcome our current limitations. We must provide ample power for our spacecraft as well as reliable and affordable transportation into space and throughout the solar system. We must deploy innovative sensors to probe Earth, other planets, and other solar systems. We must be able to communicate large volumes of data across vast distances, so that we can get the most from our robotic explorers. And we must learn to mitigate the physiological and psychological limitations of humans to withstand the harsh environment of space.

To address these and other challenges, we must build upon the strategic investments we are making in the FY 2003 Budget and pursue critical new opportunities. Consequently, our FY 2004 Budget request includes nine new initiatives:

- *Project Prometheus* will use breakthrough nuclear propulsion and power systems to fuel an ambitious mission to Jupiter's icy moons, which astrobiologists believe could harbor organic material, and lay the groundwork for even more ambitious exploration missions in the coming decades. The FY 2004 budget request includes $93 million for this initiative, and $2.07 billion over five years.
- *Human Research Initiative* will conduct biomedical research and develop technologies to enable safe and efficient long-duration space missions, including potential future missions beyond low-Earth orbit. This initiative will provide knowledge and technology for efficient life support on the ISS, and has potential medical benefits for millions here on Earth. The FY 2004 budget request includes $39 million for this initiative, and $347 million over five years.
- *Optical Communications Initiative* will invest in revolutionary laser communications technologies that will allow planetary spacecraft to transmit large volumes of scientific information, and will be demonstrated on a Mars mission in 2009. The FY 2004 budget request includes $31 million for this initiative, and $233 million over five years.
- *Beyond Einstein Initiative* will launch two Einstein Observatories: LISA (Laser Interferometer Space Antenna), a deep-space-based gravity wave detector that will open our eyes to the as-yet-unseen cosmic gravitational radiations; and Constellation-X, a mission that will tell us what happens to matter at the edge of a black hole. In addition, the FY 2004 budget request provides funding to initiate Einstein Probes, three spacecraft that will answer: "What powered the Big Bang?" (the *Inflation* Probe); "How did black holes form and grow?" (the *Black Hole Finder* Probe); and, "What is the mysterious energy pulling the Universe apart?" (the *Dark Energy* Probe). The FY 2004 budget request includes $59 million for this initiative, and $765 million over five years.
- *Climate Change Research Initiative* is an interagency effort to accelerate research targeted at reducing key scientific uncertainties to help the Nation chart the best course

forward on climate change issues. The FY 2004 budget request includes $26 million for this initiative, and $72 million over five years.

- *Aviation Security Initiative* will develop technologies to help reduce the vulnerability of aviation to terrorist and criminal attacks. The FY 2004 budget request includes $21 million for this initiative, and $225 million over five years.
- *National Airspace System Transformation Augmentation* will accelerate the development of technology to help address efficiency, capacity and security needs. The FY 2004 budget request includes $27 million for this initiative, and $100 million over five years.
- *Quiet Aircraft Technology Acceleration* will develop technology to help significantly reduce community noise impact and achieve significant savings in amelioration programs. The FY 2004 budget request includes $15 million for this initiative, and $100 million over five years.
- *Education Initiative* includes funding for NASA's Educator Astronaut Program, NASA Explorer Schools, NASA Explorer Institutes, and Scholarship for Service. The FY 2004 budget request includes $26 million for this initiative, and $130 million over five years.

While there has been additional funding provided to NASA's previous five-year budget runout to provide for these new initiatives, the balance of the funds for the initiatives has resulted from reprioritization of future funding to more appropriately pursue the Agency's Vision/Mission and goals. These initiatives will plant the seeds to enable future achievements. From them, we will continually advance the boundaries of exploration and our knowledge of our home planet and our place in the universe. We seek answers along many paths, multiplying the possibilities for major discoveries. The capabilities we develop may eventually enable humans to construct and service science platforms at waypoints in space between Earth and the Sun. Someday, we may use those same waypoints to begin our own journeys into the solar system to search for evidence of life on Mars and beyond.

Mr. Chairman, as I indicated above, there is one additional point that I wish to make. I would like to briefly discuss the state of our workforce, the lifeblood of this Agency. Last year, NASA submitted to the Congress a series of legislative proposals to help the Agency reconstitute and reconfigure our workforce. These provisions, for the most part, mirrored tools contained in the President's proposed Managerial Flexibility Act, and three of them have since been enacted on a Government-wide basis in the Homeland Security Act. NASA's workforce is an aging workforce. At the time of Apollo 17, the average age of the young men and women in Mission Control was 26 years; today, we have three times as many personnel over 60 years of age as under 30 years of age. Within five years, nearly 25 percent of NASA's current workforce will be eligible to retire. Since 1999, there have been at least 18 studies and reports concerning the workforce challenges facing NASA. The potential loss of this intellectual capital is particularly significant for this cutting-edge Agency that has skills imbalances.

Chairman Boehlert introduced H.R. 1085, the NASA Flexibility Act, which provides many of the human capital provisions that we feel are critical in our ability to reconstitute and reconfigure the NASA workforce. We support those provisions that are identical to the NASA human capital legislation submitted by the Administration in the last Congress; I am hopeful that these provisions will be enacted expeditiously this year, and ask for the Subcommittee's support of these important proposals.

In addition, the Senate Subcommittee on Oversight of Government, Management, Restructuring and the District of Columbia of the Committee on Government Affairs held a hearing on March 6 on NASA's workforce challenges, and the Committee is moving forward with S. 610, which is

critical to NASA's ability to reconstitute and reconfigure our workforce. We support those provisions that are identical to the NASA human capital legislation submitted by the Administration in the last Congress; I am hopeful that these provisions will be enacted expeditiously this year, and ask for the Subcommittee's support for these important proposals.

Mr. Chairman, appended to my testimony, as Enclosure 1, is a chart displaying NASA's FY 2004 five-year budget request. Also appended, as Enclosure 2, is a summary of the significant progress that NASA has made in the past year on a number of important research and exploration objectives, and a detailed summary of NASA's FY 2004 budget request.

The *Columbia* accident has reminded me that we cannot stop dreaming. We cannot stop pursuing our ambitious goals. We cannot disappoint future generations when we stand at the threshold of great advances. Mr. Chairman, I believe that NASA's FY 2004 budget request is well conceived and worthy of the favorable consideration by the Subcommittee. I am prepared to respond to your questions.

Enclosure 2

Summary

NASA Accomplishments during 2002
and
FY 2004 Budget Request

NASA has made significant progress during 2002 on a number of important research and exploration objectives. During the past year, NASA:

- Captured a dramatic new portrait of the infant universe in sharp focus. NASA's Wilkinson Microwave Anistropy Probe revealed the first generation of stars that began shining only 200 million years after the big bang and forecasted the age of the universe at 13.7 billion years old. Most striking though was the probe's discovery that the universe will probably expand forever.
- Upgraded the Hubble Space Telescope on *Columbia's* mission (STS-109) in March 2002. *Columbia's* astronauts installed new solar panels, a better central power unit and a new camera that increased Hubble's "vision" tenfold, and revived a disabled infrared camera using an experimental cooling system.
- Celebrated Riccardo Giacconi's 2002 Nobel Prize in Physics for his pioneering NASA sponsored work in the field of X-Ray astronomy. This work has led to important discoveries about the nature of black holes, the formation of galaxies, and the life cycles of stars.
- Demonstrated a prototype device that automatically and continuously monitors the air for the presence of bacterial spores that may be used to detect biohazards, such as anthrax.
- Made progress on the development of a radar system for aircraft that detects atmospheric turbulence, thus improving prospects for commercial airliners to avoid the kind of bumpy weather most airline passengers find uncomfortable.
- Advanced technology to reduce airliner fuel tank fires or explosions, in our effort to make air travel safer and more secure.
- Began tests on a technology effort to develop lighter-weight flexible-wing aircraft.
- Measured through the Mars Odyssey spacecraft enough water ice buried deep under the poles of the red planet, that if thawed, could fill Lake Michigan twice over.
- Discovered for the first time, a planetary system, circling the nearby star 55 Cancri, with a Jupiter-sized planet at about the same distance for its parent star as our own Jupiter is from our sun. This discovery enhances the possibility that Earth-like planets could exist in such systems throughout the galaxy.
- Conducted Earth Science research that may one day allow public health officials to better track and predict the spread of West Nile Virus or similar diseases.
- Worked to develop cutting-edge technologies that will increase our weather forecasting capability from the current three-to-five-day accuracy level up to a seven-to-ten-day level within this decade.
- Observed the disintegration of the Antarctic Larsen Ice Shelf and the seasonal acceleration of the Greenland ice sheet.
- Encouraged thousands of students to learn more about space exploration through a nationwide contest to "Name the Rovers" that will launch toward Mars this year.
- Published, "Touch the Universe: A NASA Braille Book of Astronomy," a book that for the first time presents for visually impaired readers color images of planets, nebulae,

stars, and galaxies. Each image is embossed with lines, bumps, and other textures. The raised patterns translate colors, shapes, and other intricate details of the cosmic objects, allowing visually impaired people to feel what they cannot see.

- Celebrated a second year of continuous human habitation on the International Space Station, the largest and most sophisticated spacecraft ever built, and continued assembly with four Space Shuttle missions.
- Reflecting the Agency's increased ISS research tempo, conducted approximately 48 research and technology development experiments aboard Station, including the first materials science research aboard Station, testing medical procedures for controlling the negative effects of space flight and increasing understanding of changes to bone and the central nervous system that occur in space. Astronauts conducted advanced cell culturing research, broke new ground in the study of dynamic systems, made up of tiny particles mixed in a liquid (colloids), and installed three new Station experiment equipment racks.

FY 2004 Budget Detail

Space Science Enterprise

The Space Science Enterprise seeks to answer fundamental questions about life in the universe, including how it arose, its mechanisms, where in the solar system it may have originated or exist today, and whether there are similar planetary environments around other stars where the signature of life can be found. The Enterprise also seeks to understand how the universe began and evolved, how stars and galaxies formed, and how matter and energy are entwined on the grandest scale. The proposed FY 2004 budget for the Space Science is $4.007 billion. The five theme areas in the Space Science Enterprise are:

Solar System Exploration

We are blessed to live in a fascinating neighborhood, one that we are getting to know better every day. This theme seeks to understand how our own Solar System formed and evolved and to determine if life exists beyond Earth.

The Administration's FY 2004 budget request is $1,359 million. The budget request will support: the launch of the Deep Impact mission to probe below the surface of comet Temple-1 in January 2004; the Stardust spacecraft's January 2004 encounter with the comet Wild-2, and Stardust's return to Earth with dust samples from the comet in 2006; the March 2004 launch of the MESSENGER mission to explore Mercury, our least explored terrestrial planet; the arrival at Saturn of the Cassini spacecraft in July 2004, following a seven-year journey; and the return to Earth in September 2004 of the Genesis spacecraft with its samples of the solar wind following its two-year "sunbath". The budget also contains funding for the New Frontiers program to explore the outer planets in the Solar System and for Astrobiology research to improve our ability to find and identify potential life harboring planets.

We are very excited about two new Solar System Exploration initiatives that the budget will support. Building on the work of our Nuclear Systems Initiative, Project Prometheus is a new start to develop breakthrough power and propulsion technology that will lead to nuclear-powered spacecraft that will search early in the next decade for evidence of global subsurface oceans and possible organic material on Jupiter's three icy Galilean moons: Europa, Ganymede, and Callisto. Such advances in nuclear power and propulsion have set the stage for the next phase of outer solar system exploration.

Following in the same progress that led from Pony Express to Telegraph to Telephone, our Optical Communications initiative will use laser light instead of radio waves to revolutionize the way our spacecraft gather and report back information as they continue to scout the Solar System. Today, using conventional radio frequency communications, the Mars Reconnaissance Orbiter will take 21 months to map 20 percent of the red planet's surface. By contrast, optical communications would allow the *entire* surface to be mapped in four months. The budget will support a demonstration of the technology in 2009 using a Mars orbiting satellite that will relay data to high-altitude Earth balloons. If successful, this technology promises to achieve dramatic reductions in the cost per byte of data returned and could ultimately replace the Deep Space Network.

Mars Exploration

The Mars Odyssey spacecraft's discovery of large quantities of water frozen beneath the Mars' polar areas provides additional tantalizing evidence that our neighboring planet had a wet and warmer past. This water and hints of relatively recent liquid water flows make Mars the most likely place to seek evidence of ancient or present extraterrestrial life. Mars is also worth studying because much can be learned comparatively between the current and past geology, atmospheres, and magnetic fields of Earth with Mars. We also hope to advance our understanding of Mars because some day in the not so distant future, human explorers may take humanity's next giant leap to the Red Planet.

The proposed Mars exploration budget is $570 million. This request will support our goal of 90 days of surface operations of the twin Mars Exploration Rovers, set to begin in January and February of 2004 at sites where ancient water once flowed.

The budget also supports the continued development of: the Mars Reconnaissance Orbiter, a spacecraft that will map Martian surface features as small as a basketball in 2005; the Mars Science Laboratory, a rover that will traverse tens of kilometers over Mars in 2009 and last over a year, digging and drilling for unique samples to study in its onboard laboratory; and the telecommunications satellite that will demonstrate our laser light optical communications technology in 2009.

Astronomical Search for Origins

The astounding portrait of the infant universe captured by NASA's Wilkinson Microwave Anistropy Probe provides one more demonstration of the human capacity to probe more deeply into the mysteries of creation. This theme strives to answer two profound questions: Where did we come from? Are we alone? It does so by observing the birth of the earliest galaxies and the formation of stars, by finding planetary systems in our galactic neighborhood, including those capable of harboring life, and by learning whether life exists beyond our Solar System. One year may seem inconsequential in a Universe that is 13.7 billion years old, but as we learned during the last year, a great deal of knowledge and understanding can be obtained in the period it takes the Earth to orbit the Sun.

The Administration's proposed FY 2004 budget request for the Astronomical Search for Origins is $877 million. The budget will provide funding for: continued operations of the Hubble Space Telescope; the development of the next-generation James Webb Space Telescope and the Space Interferometry Mission, a device scheduled for launch in 2009 that will increase our ability to detect planets around nearby stars; and initial science operations of the Space Infrared Telescope

Facility, the final mission of NASA's Great Observatory Program. The budget was also designed to support the final Space Shuttle servicing mission to the Hubble Space Telescope, a mission that is now on hold pending the report of the Columbia Accident Investigation Board.

Structure and Evolution of the Universe

This theme seeks to understand the nature and phenomena of the Universe. It seeks to understand the fundamental laws of space, time and energy and to trace the cycles that have created the conditions for our own existence. This is accomplished in part by observing signals from the Big Bang, mapping the extreme distortions of space-time about black holes, investigating galaxies, and understanding the most energetic events in the universe. The theme also attempts to understand the mysterious dark energy that pervades the Universe and determines its ultimate destiny.

The proposed budget for this theme is $432 million, which will support development of the Gamma-ray Large Area Space Telescope, a mission to study high-energy objects like black holes.

The budget will also support a new initiative that will honor the continuing legacy of Albert Einstein, some 99 years after Einstein developed his theory of Special Relativity. The Beyond Einstein initiative will attempt to answer three questions left unanswered by Einstein's theories: What powered the Big Bang? What happens to space, time, and matter at the edge of a black hole? What is the mysterious dark energy expanding the Universe? Under the initiative, a Laser Interferometer Space Antenna will use three spacecraft "formation flying" five million kilometers apart in a triangle to observe the distortion of space due to gravity waves. Also, Constellation-X, an X-ray telescope 100 times more powerful than all existing X-ray telescopes, will use a team of powerful X-ray telescopes working in unison to observe black holes, investigate "recycled" stellar material, and search for the "missing matter" in the universe. Finally, the initiative will support Einstein Probes, a program that will begin later this decade, consisting of fully and openly competed missions (in the manner of the Discovery, Explorers, and New Frontiers programs) to conduct investigations that benefit science objectives within the theme.

Sun-Earth Connections

We should never take our life-sustaining Sun for granted. NASA's Sun-Earth Connections theme investigates our Sun and how its structure and behavior affect Earth. NASA seeks to understand how the variability of solar radiation affects Earth's climate, and how we can better predict solar flares that affect the upper atmosphere and can damage satellites and disable the power distribution grid on the ground. NASA also uses the Sun as an ideal laboratory for researching basic physics and learning how other stars function.

The proposed budget for NASA's Sun-Earth Connections theme is $770 million. The budget will support the development of the STEREO, the Solar Dynamics Observatory and future flight missions. Scheduled for a 2005 launch, STEREO will use two identically equipped spacecraft to provide revolutionary 3-D imaging of coronal mass ejections. The Solar Dynamics Observatory, which will study the Sun's magnetic field and the dynamic processes that influence space weather, will enter implementation of development in January 2004.

Earth Science Enterprise

In the near-half century that we have lived in the "space age" the most interesting planet that NASA spacecraft have explored is our own home in the universe. Spacecraft observations

combined with atmospheric, ground-based and oceanic measurements have enabled a systematic study of Earth processes, leading to important scientific advances and tangible benefits to the American public. NASA's vision of "improving life here" starts with the Earth Science Enterprise's study of planet Earth from space. The Enterprise seeks to understand and protect our home planet by advancing Earth system science and applying the results to improve prediction of climate, weather, and natural hazards. The proposed FY 2004 budget for Earth Science is $1,552 million. The two theme areas for Earth Science are:

Earth System Science

Within this theme, NASA is deploying and operating the first comprehensive constellation of Earth-observing research satellites designed to reveal interactions among Earth's continents, atmosphere, oceans, ice, and life. These interactions produce the conditions that sustain life on Earth. Data and information from NASA satellites enable researchers to understand the causes and consequences of global change and inform the decisions made by governments, businesses, and citizens to improve our quality of life.

The $1.477 million FY 2004 budget request for Earth System Science will support the launches in 2004 of three complementary formation-flying polar orbiting satellites, which in effect will become a super-satellite. They are: AURA, which will study Earth's ozone, air quality and climate; Cloudsat, which will measure the structure of clouds to better quantify their key role in the Earth's water cycle and climate system; and CALIPSO, the NASA-French project to determine how the climate, aerosols and clouds interact. Calipso, coupled with Aura and an advanced polarimeter slated for launch in 2007 under an initiative to accelerate evaluation of non-carbon dioxide (CO2) impacts on climate change as part of the Administration's Global Climate Change Research Initiative, will help determine the role of aerosols in climate, reducing one of the largest uncertainties in climate models.

Significantly, the Earth System Science budget will also provide $524 million, in conjunction with the administration's Global Climate Change Research Initiative, for research and modeling that will help answer critical scientific questions on climate change to aid policy and economic decision makers.

Other major Earth Science work in 2004 that the budget will support include: Using satellite observations to provide daily and seasonal global atmospheric water vapor, rainfall, snowfall, sea-ice and ice-sheet maps to improve the scientific understanding and modeling of water cycles throughout the Earth system; Improving the predictive capabilities of regional weather models through satellite-derived localized temperature and moisture profiles; and assimilating satellite and in situ observations into a variety of ocean, atmospheric, and ice models for the purpose of estimating the state of Earth's seasonal and decadal climate.

The budget will also support the National Polar-orbiting Operational Environmental Satellite System (NPOESS) Preparatory Project under development in partnership with the National Oceanic and Atmospheric Administration and the Department of Defense. This project, slated for launch in 2006, will maintain the continuity of certain environmental data sets that were initiated with NASA's Terra and Aqua satellites, prior to the launch of the operational NPOESS system in 2009. Also supported with be the Landsat data continuity mission, an innovative program to seek partnerships with industry that use critical land remote sensing data.

Earth Science Applications

NASA recognizes that by working in partnership with other Federal agencies, we can leverage our research results and Earth observation information products to provide significant benefits to the American public. Within our Earth Science Applications theme we have identified applications where we can improve decision support systems, such as weather prediction models and near-airport terrain databases operated by our partner agencies. For each application, joint research and demonstration projects are under way or being developed. We are also developing crosscutting solutions that advance the use of NASA information and technology across a range of potential new applications.

The $75 million FY 2004 budget request for Earth Science Applications will support a focus on 12 specific applications of national priority where other agencies' decision support systems can be markedly improved based on NASA-provided data and information. In 2004, NASA intends to benchmark improvements to air quality and agricultural productivity and competitively select projects for the Research, Education, Applications Solutions Network (REASON) program to serve national priorities.

Biological and Physical Research Enterprise

On their 16-day mission of exploration and discovery the seven *Columbia* astronauts conducted medical investigations related to cancer, osteoporosis and kidney stones, all with the goal of advancing our understanding of nature and the world we live in. The research operations were smooth and productive, with new phenomena being observed in combustion science and in cell science. As Commander Rick Husband said, "I think one of the legacies of NASA is that you always push forward. And STS-107 is doing that on the science side—pushing human science knowledge forward."

Our Biological and Physical Research Enterprise exists to push the frontiers of science forward. The Enterprise uses the rich opportunities provided by space flight to pursue answers to a broad set of scientific questions, including those about the human health risks of space flight. The space environment offers a laboratory, unique in the history of science, that allows the study of biological and physical processes. Experiments that take advantage of this environment extend from basic biology to quantum mechanics and from fundamental research to research with near-term applications in medicine and industry.

The proposed FY 2004 budget for Biological and Physical Research is $973 million. The three theme areas in Biological and Physical Research are:

Biological Sciences Research

Within this theme, NASA determines ways to support a safe human presence in space. We are conducting research to define and control the physiological and psychological risks posed to human health by exposure in space to radiation, reduced gravity, and isolation. This theme also conducts research and development to improve the performance of life support systems. It includes a basic biology research component that seeks both to pursue fundamental biological research questions from cell to tissues to whole organisms which produce results that can support advanced methods for enabling the continued human exploration of space.

The proposed $359 million FY 2004 budget for Biological Sciences Research will fund expanded ground research into how humans can adapt to the hazards of space flight for unprecedented

periods of time under a new Human Research Initiative. A flight program in high priority areas of advanced human support technology to reduce mass to orbit and beyond for life support equipment by a factor of three is also funded by this Initiative.

Physical Sciences Research

This theme supports research that takes advantage of the unique environment of Space to expand our understanding of the fundamental laws of nature. We also support applied physical science research to improve safety and performance for human exploration and research that has applications for American industry.

Activities in this theme are structured to respond to the Research Maximization and Prioritization Task Force process, undertaken last year to prioritize BPR research activities. The budget request of $353 million will support major space flight hardware development for physical sciences research on the International Space Station, while reducing funding for lower priority areas such as biomolecular technology, and structural biology future facility class space flight hardware, and level II program management support. The budget will increase funding for research of strategic importance to NASA's long range-goals, including radiation protection and basic research enabling knowledge for power and propulsion technologies. The budget also contains funding for our new Human Research Initiative, with funds targeted for spacecraft system innovations such as less massive fluid and thermal control methods and fire safety improvements.

In 2004, the budget supports the preparation of the first major Physical Sciences Research facility rack to the International Space Station, and the beginning of prime research facility operations on the Space Station.

Research Partnerships and Flight Support

The Research Partnership element of this theme establishes policies and allocates space resources to encourage and develop research partnerships in the pursuit of NASA missions and Enterprise scientific objectives. This research supports product development on Earth and leverages industry resources to accelerate progress in our strategic research areas. Ultimately, Research Partnerships may support development of an infrastructure that can be applied to human exploration.

A majority of the proposed $261 million budget in FY 2004 for Research Partnerships and Flight Support will apply to the Flight Support element of this theme. The Flight Support element will be augmented by two activities: (1) the transfer of the Alpha Magnetic spectrometer program management and budget from Physical Sciences Research; and, (2) the consolidation of the Enterprise Support program content and budget, previously diffused across various programmatic components. The Flight Support activity includes multi-user hardware development, payload integration and training, and payload operations support.

The budget also provides for the restructuring of NASA's Space Product Development program by aligning industrial partnerships with NASA mission needs and Enterprise scientific objectives. We intend to review our existing Research Partnership Centers to determine which of these will be retained.

Aerospace Technology Enterprise

The Aerospace Technology Enterprise contributes to the NASA Vision by pioneering and developing advanced technologies. These technologies, in turn, improve the air transportation system, access to space, and science missions. This Enterprise also develops technology partnerships with industry and academia outside traditional aerospace fields. The Aerospace Technology Enterprise is comprised of four themes:

Aeronautics Technology

NASA's Aeronautics Program develops technologies that can help create a safer, more secure, environmentally friendly and efficient air transportation system, increase performance of military aircraft, and develop new uses for science or commercial missions. This theme also enhances the Nation's security through its partnerships with the Department of Defense (DOD) and Federal Aviation Administration (FAA) and the Department of Homeland Security. Research areas include advanced propulsion technologies, lightweight high-strength adaptable structures, adaptive controls, advanced vehicle designed, and new collaborative design and development tools. In collaboration with the FAA, research is conducted in air traffic management technologies for new automation tools and concepts of operations. Major funding allocation includes three technology initiatives in aviation security, airspace systems, and quiet aircraft.

The FY 2004 budget request for Aeronautics is $959 million. It includes $169 million for Aviation Safety and Security projects, $217 million for Airspace Systems, and $574 for Vehicle Systems. The budget request includes funding for three new initiatives:

- Aviation Security—the budget includes $21 million for this new initiative ($225 million over five years); it will develop technology for commercial aircraft and airspace protection, including development of damage-tolerant structures and autonomous and reconfigurable flight controls technology to prevent aircraft from being used as weapons and to protect against catastrophic loss of the aircraft in the event of damage from sabotage or explosives.

- National Airspace System Transition—the budget includes $27 million for this new initiative ($100 million over five years); it will enable technology, in cooperation with the FAA, to transition to a next-generation National Airspace System that would increase the capacity, efficiency, and security of the system to meet the mobility and economic-growth needs of the Nation, reducing delays and increasing air transportation efficiency.

- Quiet Aircraft Technology—the budget includes $15 million for this new initiative ($100 million over five years); it will accelerate development and transfer of technologies that will reduce perceived noise in half by 2007 compared to the 1997 state-of-the-art.

Space Launch Initiative

The objective of the Space Launch Initiative is to ensure safe, affordable, and reliable access to space. Funding is focused on the Orbital Space Plan (OSP) program to develop a crew rescue and transfer capability, and on the Next Generation Launch Technology program for advanced kerosene engine development and hypersonic propulsion research and testing. The FY 2004 budget request is fully consistent with the FY 2003 Budget Amendment submitted to Congress in November 2002.

The FY 2004 budget request includes $1.065 billion for SLI, including $550 million for the OSP to develop a crew return capability from Space Station by 2010 and crew transfer capability atop an expendable launch vehicle by 2012. Funding will support technology demonstrators such as X-37 and advanced design studies. The budget request also includes $515 million for the Next Generation Launch Technology Program to meet NASA's future space launch needs. Funding includes advanced kerosene engine development and hypersonic propulsion research and testing.

The budget envisions several key events in 2004:

- Test flight of DART vehicle to demonstrate autonomous rendezvous technology between a chase vehicle and an on-orbit satellite;
- Drop test of X-37 vehicle from carrier aircraft to demonstrate autonomous landing capability as a precursor to a possible orbital demonstration; and,
- Preliminary design review of OSP to support a full-scale development decision.

Mission and Scientific Measurement Technologies

This Theme develops crosscutting technology for a variety of aviation and space applications. Funding is focused on communications, power and propulsion systems, micro-devices and instruments, information technology, nanotechnology, and biotechnology. These technology advances will have the potential to open a new era in aviation and allow space missions to expand our knowledge of Earth and the universe.

The FY 2004 budget request is $438 million, which includes $233 million for Computing, Information, and Communications Technologies, $44 million for Engineering for Complex Systems, and $161 million for Enabling Concepts and Technologies.

Innovative Technology Transfer Partnerships

This theme develops partnerships with industry and academia to develop new technology that supports NASA programs and transfers NASA technology to U.S. industry. The FY 2004 budget request introduces a creative partnership program to sponsor dual use technologies, called Enterprise Engine, and is discontinuing the existing centralized commercial technology promotion efforts and, instead, recompeting and refocusing our technology transfer programs across the Enterprises to maximize benefits to NASA and the taxpayer.

The FY 2004 budget request is $169 million, which includes $5 million for the Enterprise Engine, $33 million for recompeting and refocusing technology transfer efforts to maximize benefits, and $131 million for the SBIR/STTR programs.

Education Enterprise

Education is NASA's newest Enterprise, established in 2002, to inspire more students to pursue the study of science, technology, engineering and mathematics, and ultimately to choose careers in those disciplines or other aeronautics and space-related fields. The new Enterprise will unify the educational programs in NASA's other five enterprises and at NASA's 10 field Centers under a One NASA Education vision. NASA's Education will permeate and be embedded within all the Agency's activities.

NASA's Education Program will provide unique teaching and learning experiences, as only NASA can, through the Agency's research and flight capabilities. Students and educators will be able to work with NASA and university scientists to use real data to study the Earth, explore

Mars, and conduct other scientific investigations. They will work with NASA's engineers to learn what it takes to develop the new technology required to reach the farthest regions of the solar system and to live and work in space. It is important that the next generation of explorers represents the full spectrum of the U.S. population, including minority students and those from low-income families. To ensure the diversity of NASA's workforce, our educational programs pay particular attention to under-represented groups. NASA Education will support our Nation's universities to educate more students in science and engineering by providing meaningful research and internship opportunities for qualified students, plus a roadmap for students to seek NASA careers.

The FY 2004 budget request of $170 million includes $78 million for education programs including the continuation of pipeline development programs for students at all educational levels with the continuation of Space Grant/EPSCOR programs and $92 million for Minority University Research and Education. It also includes $26 million for an Education Initiative that encompasses the Educator Astronaut Program, NASA Explorer Schools Program, Scholarship for Service, and Explorer Institutes.

Space Flight Enterprise

International Space Station

This theme supports activities for continuing a permanent human presence in Earth orbit—the International Space Station. The Space Station provides a long-duration habitable laboratory for science and research activities to investigate the limits of human performance, expand human experience in living and working in space, better understand fundamental biological and physical processes using the unique environment of space, and enable private sector research in space. The Space Station allows unique, long-duration, space-based research in cell and development biology, plant biology, human physiology, fluid physics, combustion science, materials science, and fundamental physics. It also provides a unique platform for observing the Earth's surface and atmosphere, the Sun, and other astronomical objects.

The Space Station program is well on its way to completing work on the U.S. Core Complete configuration, which will enable accommodation of International Partner elements. Flight elements undergoing ground integration and test are proceeding on schedule, and the last U.S. flight element is scheduled for delivery to NASA by the spring of 2003. FY 2004 funding drops as planned, as development activities near an end, and on-orbit operations and research becomes the focus of the program. The budget maintains proposals reflected in the FY 2003 Budget Amendment, including additional funds for reserves and funding for Node 3 and the Regenerative Environmental Control and Life Support System (ECLSS). The budget continues significant progress toward resolving the Space Station management and cost control issues that confronted the program at the end of 2001. Many changes based on recommendations of the ISS Management and Cost Evaluation (IMCE) task force have increased NASA's confidence in achieving success with the U.S. Core Complete station. Management changes have been made to ensure that ISS capabilities are driven by science requirements, and to make appropriate decisions as the program moves from development into operations.

Space Shuttle

The Shuttle, first launched in 1981, provides the only capability in the United States for human access to space. In addition to transporting people, materials, and equipment, the Space Shuttle

allows astronauts to service and repair satellites and build the Space Station. The Space Shuttle can be configured to carry different types of equipment, spacecraft, and scientific experiments that help scientists understand and protect our home planet, explore the universe, and inspire the imagination of the American people.

FY 2004 budget request of $3.968 billion supports the planned steady state flight rate of 5 launches per year beginning in FY 2006. It provides $379 million (and $1.7 billion over five years) for the Space Shuttle Service Life Extension Program, which will improve safety and infrastructure needs to allow flying of the Space Shuttle well into the next decade.

Space and Flight Support

The FY 2004 budget request of $434 million supports space communications, launch services, rocket propulsion testing, and advanced systems. Funding is provided for cleanup of the Plumbrook facility and tracking and data relay satellite follow-on studies. The overall funding level reflects the planned transfer of certain space operations responsibilities to other Enterprises.